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NATURAL HISTORY IN THE GRADES

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III. THIRD GRADE

A general review of the plants and animals used in grades one and two should constitute the first work in the third grade. This review is needed in order first to keep clearly defined the individual characteristics of different things that were studied and second to recall and re-establish the more difficult matters that were encountered in such processes as relate to climatic changes and the life round of the three types of animal life used most extensively in the second grade. It will be well to introduce into the third-grade room in autumn some cocoons, tadpoles or young frogs by means of which to review and extend the work that was done in the preceding spring. Related types as the salamanders and newts are found as a regular part of the lists of materials suggested for the grade, but these are all the more profitably used if preceded by a brief review study of the toad, the cecropia moth and cocoon, the story of how the pigeons built their nests and reared their young, and by the preparation of lists and brief discussion of the different groups of materials as trees, insects, rocks, soils, and weather phenomena, which have already been studied.

The topics included in this grade are :

I. *Animal life*.—Squirrel or some similar animal kept by the grade; further study of the life cycle and feeding habits of the toad, the salamander, showing its external gills, its form and behavior as compared with the toad; the cabbage butterfly grown through its metamorphoses and the parts mounted to illustrate the life cycle; water insects—dragon flies and mosquitos, the swimming, feeding, and resting habits of adults and particularly of the young that may be kept in the school-

room aquaria; effects of insects upon garden plants as of the caterpillars upon the currant bushes which are under the especial care of this grade and which when caterpillars appear are sprayed or sprinkled by the grades, some of the caterpillars being kept in cages for study; oriole, song-sparrow, night-hawk, humming bird, brown thrush, blackbird, cow-bird, warblers, a few observations upon bird migration, upon the nesting and feeding habits of these birds, especially upon the ways in which warblers feed upon scale insects upon trees; if possible study in some detail the nesting habits of at least one kind of bird comparing it with the pigeon work done in the preceding grade; some discussion of the balance of life between insects and birds, and in aquaria and ponds between insects and fish, toads, frogs, etc.; add any common land animals of the region not already included in preceding grades, and use true stories descriptive of wild and domesticated animals of this and other regions; the possession of pet animals and children's literature dealing with animal life fit well into this grade.

2. *Plant life*.—In addition to the review of the trees studied in the preceding grade, add the mulberry, box-elder, and two or three others of the most available kinds. Study the form of these and in discussion and sketches establish definite ideas of the characteristics of the different trees that are used. If good enlarged photographs of typical trees of the kinds that are included are placed on the walls they will be helpful, and will be sufficiently unlike those of the vicinity which the pupils are studying to allow all the originality that may be wished. Such photographs may be secured from R. B. Hough, Lowville, N. Y., and also from other sources, but local trees that the teacher or others may have taken in the general vicinity of the school are quite as good and have the additional advantage of the local "color" that adds so much both to teacher and pupil. In the next grade more extended work with the lumber industries is suggested, and this individual study of trees in this grade will assist greatly in the following work.

Acquaintance with plants of the vacant lots of the region should be extended, including the rag-weed, cockle-bur, wild pars-

ley, butter-print, and burdock. The names and general characteristics of the plants and animals that are growing in the aquaria in the room should be made the basis of a few lessons. The most extensive work of this grade is done with the bulbs, which will be separately discussed at the close of this article. This work is carried on throughout the latter part of the autumn, winter, and early spring, both in connection with the garden and with the indoor study.

3. *Garden work.*—Instead of having the whole grade have one, or but two or three gardens, as suggested for the lower grades, a better plan for this grade is to have each group of three or four pupils have a garden together, or if abundant space is available, to have each pupil possess one garden entirely alone. Outdoor studies of the soil, planting, germination, watering, weeding, cultivation, characteristics of the plants in different stages of their growth, and the care that they need to keep them in proper condition are the leading topics that relate to the garden work for this grade. The children make their own plans for their gardens, and under the advice of the teacher select the plants that they are to grow. This must be carefully guarded lest they will select things that are not possible for the region or for the area at their disposal. The suggestions of the teacher are usually sufficient to determine proper selection by the pupil. It will be found best usually to have each pupil grow a few kinds both of vegetables and of flowering plants. A good plan is to divide the bed into a vegetable garden and a flower garden so that all may have a chance at all both useful and ornamental plants that are available for general use. In the next year the pupils are asked to plan for their gardens by making drawings to scale showing just the amount of space to be used and the use to be made of each part of it, and a statement of the appearance that is imagined when the plants are grown. In the third grade this planning is carried on under the close supervision of the teacher. In this way the class and teacher work out the plans before the time for the outdoor work. This serves to increase the interest in the garden and to give definiteness and meaning

to it. In connection with the fourth-grade outline, one or more detailed sample plans for gardens will be presented.

It will be of interest and value to grow in the schoolroom during the latter part of the winter or early spring some of the seeds that are to be used later out-of-doors in order that the pupils may get an idea of the characteristics and appearance of the plants that they are to grow, and may learn to distinguish them from the weeds of the garden.

The earth materials and meteorological materials for this grade are not arranged as separate groups but are treated, in so far as they appear at all, in connection with the garden work. Considerable study of the soil and of the conditions that are favorable for the successful growth of the plants of the garden are constantly discussed, the center of the natural-history work of the grade being the garden and bulb work, hence the inclusion of these things here rather than in separate topics.

4. *The indoor work with bulbs.*—General outlines for this work were given in the October, 1909, *Elementary School Teacher*, to which reference is made, and knowledge of which will be assumed in the following discussion. It is the present purpose rather to give an outline of a few of the detailed problems that the pupils can do with profit in the schoolroom. Enough bulbs should be supplied to allow each pupil to have one each of the kind selected for the main work and also to supply several kinds of less common bulbs for general possession and study by the entire grade. The paper white narcissus, Chinese sacred lily, or hyacinth are probably best for the experimental work. But for comparison there should be provided a good supply of several other kinds, as hyacinths, crocuses, tulip, Freesias, Amaryllis, and scilla. This year part of the children of the grade have been given paper white narcissus, part have been given hyacinths, and the rest Chinese sacred lilies, while the grade as a whole has a few each of several other kinds of bulbs. Considerable discussion as to the best way of planting the bulbs in question was had before the work began, and then each child did his planting under the direction of the teacher.

After planting, the bulbs were well watered and placed in a dark and cool room, where they should be kept for weeks, until after the holiday season unless they grow more rapidly than is expected. They need to be watered just enough to keep the soil from drying out, but care must be taken to see that the soil is not wet enough to allow the bulbs to decay. In this way the roots should start in a short time, and should be well under way before there is any appearance of the stem and leaves. The plants may be brought up to the schoolroom at any time after the roots are well started, and forced for winter or early flowering. Some of the potted bulbs may be planted out-of-doors by being buried in the soil or under straw, and may be brought into the schoolroom at any time that is wished. Great care must be taken to see that the earth and plants thaw out very slowly else the plants will be killed. This is best done by putting the pots first into a cool basement room for a few days, then into the schoolroom.

With the planting done, experimental work with the bulbs and a study of their parts is begun. One study as suggested by the following directions, consists of opening tulip bulbs lengthwise to determine what parts are present and how they are arranged with reference to one another. By use of a bulb that has stood in water for a few days determine where the roots arise, where the stem is, how the leaves are arranged and how they inclose the growing point. This study should be carried farther by use of bulbs that have been cut crosswise, and sketches of the bulbs in different views should be made. By use also of one or two bulbs that have been planted for a week or ten days the nature of the different parts will be interestingly shown. From this point of view further study may be made of similar bulbous plants that are growing in the room.

Another experiment that has proven valuable consisted of growing three sets of plants in different places which afforded different lighting and possibly different temperature. The pots were placed in a dark closet at the time when the bulbs were planted and others, planted at the same time, were placed in the windows, and still others in a dark cool basement room as previously described. The closeted plants developed root systems, but

produced blanched leaves and no flowers, those placed in the window soon put up their leaves and flower stocks but had developed meager root systems and finally produced small and but few flowers, while the plants that were started in the basement produced abundant roots and when brought up to the schoolroom produced large leaves and large and abundant flowers. Much interest was shown in following the development of these three groups of plants grown under different conditions. A fourth group of potted bulbs has been buried out-of-doors, and when it is brought into the room it doubtless will serve excellently as a comparison with the three groups here described, and should make possible valuable inferences as to the behavior of bulbous plants relative to soil, temperature, and light.

Another valuable series of experiments consists in determining the amount of water used by a plant and the relation of this to the amount of growth of the plant. In a fruit jar a measured amount of water was placed. Suspended to a stopper in the top of the jar a bulb was fastened, so that its lower end touched the top of the water. The cork was sealed with paraffin so that no evaporation of water from the jar could occur. The entire apparatus was weighed carefully and the weight recorded. Sketches were made of the apparatus at intervals to show the changes as they occurred. Gum labels placed on the outside of the jar served to determine whether the water was lowered from day to day. When the water was lowered and the growth such that the weight remained practically constant, interesting questions arose as to whether the growth took place directly from the water removed from the jar. Obviously some simple explanations were necessary, such as the statement that the plant took some of its food from the air about it. A further instructive experiment consisted in comparing the weight of a bulb with the weight of the whole plant that finally grew from it. It may be questioned if in this experiment we are not dealing with factors some of which are too elusive for pupils even much older than these and we must recognize that such is true. But the gross results were determined, and farther than this it would be unwise to attempt to go with children.

In one class the experiment with the bulb grown in a jar led to a study of the amount of water in the soil. The class weighed some soil, then dried it carefully, of course not being able to remove all of the water, but removing all that ordinary drying would remove, and then by weighing the dry soil determined the loss by weight, which, as they could readily understand, was a water loss. It is not intended that any extended study of the soil should be taken up until in the fifth grade. Many interesting experiments offer themselves in connection with this study; the reaching for light by plants, as shown in the window or by plants inclosed in a box so as to be lighted from but one side, budding, flowering, and seed-making, depth of planting that gives best results, differences between growth from large and small bulbs, and from those that were used by the class last year and new bulbs.

Two somewhat special features of the bulb work are being tried in this grade this year. One is to have the children grow a dozen or so pots of especially fine varieties as the newer hyacinths, crocuses, and Freesias, which, if successful, the children will present to other grades or to outside interests to which the grade may wish to contribute. Secondly, a fine Amaryllis has been secured for this grade which the grade is expected to care for and pass on at the opening of the next school year to the next third-grade class. It is hoped that another Amaryllis may be cared for by this grade and carried through all of their grade experience, and disposed of as they see fit when they finish the eighth grade.